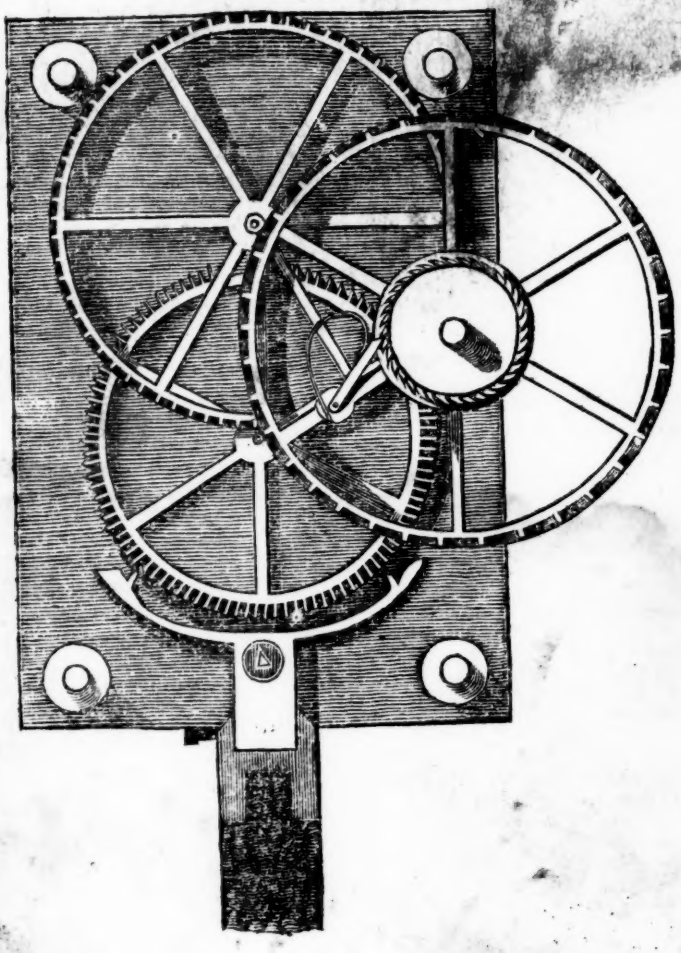
AMERICAN
MECHANICS' MAGAZINE,
Museum, Register, Journal and Gazette.

VOL. II.—No. 42.] SATURDAY, Jan. 7, 1826. [$4 PER ANN.

However bad the world may be, the extremes of wickedness are to be found among those who do not read.—KNOX.

APPLICATION OF MR. BURNETT'S PATENT TO THE CONSTRUCTION OF CLOCK WORK.

Fom the London Mechanic's Register



Specification of a patent granted to Mr. Henry Burnett, for "certain improvements in machinery for a new rotatory, or endless lever action," being an improved system of gearing, invented by his friend, Mr. H. G. Dyer, of Boston.

This valuable mechanical improvement is so ably described in the comprehensive specifiation of Mr. Burnett's Patent, that it is unnecessary for us to expatiate on its practical utility, and we need only add, that the engraving in our frontispiece represents its application to the construction of a clock, which was exhibited in Dr. Birkbeck's first lecture on the general principles of mechanical science, and which goes twelve months with once winding up. Previous to the perusal of the specification, which is illustrated by a section of the same clock, we request the attention of our readers to the following letter from Dr. Birkbeck, written in consequence of the originality of the invention having been called in question, as stated by the Doctor in his address delivered at the opening of the Brighton Mechanics' Institution:

Dear Sir,—Having, in consequence of some communications made to me, expressed a doubt respecting the originality of an ingenious mechanical contrivance, which I first made known to the British public, I feel myself bound to state what has since occurred upon the subject. This I do through your publication, because you have copied the address delivered at Brighton in which these doubts were mentioned, and have thus on account of your extensive circulation, widely disseminated them. It is likewise particularly requisite that this statement should now be promulgated, in order that the very clear and intelligent specification of Mr. Harrison Dyer's patent, which I have just had the pleasure of perusing, and which I am happy to find you intend to insert in your next number, should appear before your readers without any unfavourable impression from what I had formerly asserted.

In illustration of the advantage derivable by the mechanic from extensive reading, I mentioned in the address before alluded to, his protection against disappointment, from the idea of having accomplished a discovery, when he might only be repeating what had been previously achieved. As an instance of what might have been done by a greater acquaintance with mechanical writings, I noticed the arrangement of Mr. Dyer, which I, in common with the inventor, believed to be new, but which Mr. John Valance, a scientific inhabitant of Brighton, had assured me was described in a work, the name of which he could not then remember. Although I thought it possible that he might be mistaken as to the identity of the two contrivances, yet as he seemed decided upon the point, I considered it sufficiently established to cite as an example. As Mr. Valance informed me that the book was in town, I begged that he would allow me to inspect it immediately, for the purpose of comparing the description with Mr. Dyer's arrangements, the book, however, has not yet appeared, and I think it probable, that not finding the account such as he expected, the matter has been abandoned by him; and the patentee, I must confess, has a right to consider himself quite free from any question or opposition in this quarter.

A more direct claim of priority was preferred by Mr. Reintzsch, watchmaker to the King, which in justice to his allegations without any knowledge of the construction of his model was noticed by me upon the same occasion. This day, however, I had an opportunity of examining the arrangement, which, although very ingenious, differs in principle from that of Mr. Dyer. A series of pins are placed diagonally on the surface of a broad wheel, in a manner similar to the flat teeth used by Mr. Dyer: these pins act upon the front edges of a corresponding number of notches, made by filing down to the centre, or

removing one half of the spindle or arbor; and each notch occupying a different situation to adapt it to the position of the pin, they are thrown around the arbor in an interrupted spiral; the arbor revolving once whilst each set of pins is in action. This plan is in fact the wheel and pinion the semi diameter of the arbor answering to each leaf of the pinion and the pin, notwithstanding the difference in the mode of placing it, acting as a tooth of the common wheel. This model exhibits two advantages in common with the plan of Mr Dyer; an action near the centre of the arbor, much nearer than would be possible with a pinion, and a greater velocity in the arbor, each series of inclined pins, and the number of these may be considerable, occasioning one revolution. It does not possess the leading characteristic of the American invention, the perpetual rolling lever action, and the unvarying preservation of the line of centres as a straight line: that is to say, the centres of the arbor and the wheel, with the points of the two inclined surfaces impelling each other, uniformly being found during every part of a revolution in the same straight line.

This distinguishing feature, so obvious and indisputable as it appeared to me, could not, I must confess, be made apparent to Mr. Reintzsch: at the same time I am persuaded that very few scientific mechanics would resist the evidence, which a careful inspection must furnish, in regard to a difference of principle. As a general plan for the construction of gearing, I have not yet seen any thing which can be put in competition with Mr. Dyer's: and I hope that the complete development which follows will contribute to its extensive adoption; establishing likewise that exclusive right, which may ultimately reward the mechanical exertions of its ingenious inventor.

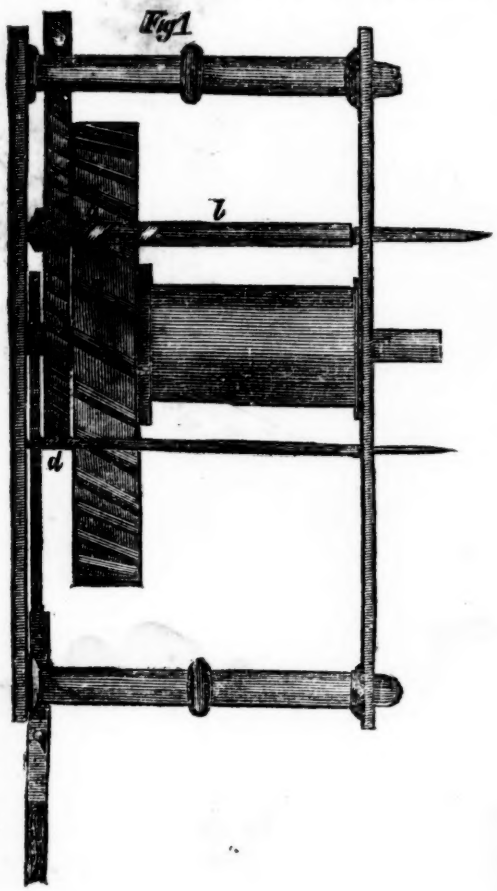
GEORGE BIRKBECK.

SPECIFICATION.

Now now ye, that in compliance with the said proviso, I, the said Henry Burnett, do hereby declare, that the nature of my said invention, and the manner in which the same is to be produced, applied, and carried into effect, is hereinafter particularly described and set forth; that is to say, my invention consists in a new arrangement and combination of mechanical principles, applicable to all purposes, where rotatory motion has been or is to be produced, by cogged or toothed wheels, and pimons, or what in large machinery is technically called gears: either for the purpose of gaining mechanical power and diminishing velocity of motion, or vice versa, for multiplying small quantities of motion, and gaining increase of speed; and in this way it is applicable to the most complex and elaborate train of wheel work or gearing, or to the most simple form in which it can be constructed. One of the most essential features in my said improvement is, that however numerous the wheels may be in any piece of machinery constructed upon my principles as hereinafter decribed, still a uniformity of action will be obtained throughout the whole, far surpassing that which could be obtained by any of the ordinary modes of constructing gears or wheel-work, and that with increased strength, and diminished friction since that which is usually a rubbing, is converted into a rolling action and only simple points are called into action at once, and these are constantly operating upon the line which joins the centres of any pair of revolving axles or pivots.

The change in the velocity of motion is likewise much increased, so that effects which before required large wheels, with very considerable numbers of teeth may, by my improvement, be brought about with much smaller wheels and lower numbers of teeth, whereby the expense of constructing machinery on my principle will be considerably reduced. The manner in which I bring about the several beneficial effects above enumerated is as follows; instead of using wheels and pinions of the form and construction generally adopted. I use wheels with bevil or oblique

teeth, such as are shown at *a e*, in fig. 1 of the annexed illustrative drawing; and instead of permitting the teeth or cogs of such wheels to act into or be acted upon by pinions or other wheels, I cause them to act into, or be acted upon by spiral grooves in the nature of endless screws, which grooves are cut and formed on the arbors, spindles, or axles, which come



into contact or gearing with such wheels as seen at *b d* in the said figure. Now, it is evident, that if the wheel *a*, be a driving wheel, or one which has power applied to it to turn it round, it will, by its motion, communicate a rotatory or revolving motion to the arbor, or spindle *b*, which carries the wheel *c* fixed upon it, and this wheel *c* will, in like manner, give rotatory motion to the spindle *d*, or if instead of imagining the moving pow-

er to be applied to the wheel *a*, we suppose it applied to the axis *d*, then a rotatory motion will be communicated to the wheel *c*, and its axis *b*, which will in like manner give a much slower motion to the wheel *a*, and thus an increase of power will be obtained proportionate to the respective velocities of *d* and *a*; and so of any additional wheels and spindles which might be introduced into the machine.

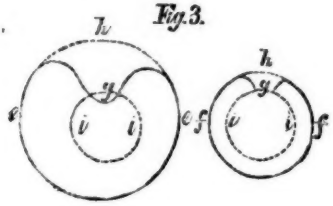
The foregoing short account contains a description of the general principles of my aforesaid invention, by which it may at first sight appear that it contains nothing more than wheels, having oblique or bevel teeth, and common endless screws to act into the same, neither of which are in themselves new or capable of being appropriated in their ordinary state, by any patentee, and accordingly in their separate and ordinary state I make no claim to them under or by virtue of my hereinbefore in part recited letters patent. But in their joint and combined state, and in the manner in which I use them, it will be found not only that the mode of using and combining them is essentially different from that commonly practised, but that they are attended with beneficial results not heretofore contemplated; and I shall therefore now proceed to point out how they differ from the ordinary modes of construction, and how I therefore ground my claim to the novelty of my invention of their use and application when combined and used as hereinbefore described. The wheel with bevil, or oblique teeth, has heretofore been used either to act into other wheels or pinions having their teeth similarly disposed, and thus producing the same relative velocity of motion as in other wheels with common teeth, or cogs; or else to act into an endless screw in the ordinary way. Now the common application of the endless screw is in the direction of a tangent line (or very nearly so) to the wheel to which it is applied, and whether it be the driver, or is driven, the direction of the force exerted by, or upon it, is constantly in a direction coincident with its longitudinal axis, and never in that of its radius; while a perfect rubbing action always takes place between the threads of the screw and the teeth with which they are engaged, thus producing an excessive friction, not only on this point of contact, but likewise on the resisting pivot of the screw, and thus, though the common endless screw is a convenient and steady driver, it can seldom be driven to advantage, unless the rake of its thread be very great, or it is assisted by the momentum of a fly wheel. In my application of the spiral or endless screw, its axis is not a tangent to the wheel with which it is engaged, but it is placed at right angles to the plane of the wheel, or parallel to its axis, in every case, except that of bevel gear, or where the two axes of motion make an angle of each other, and then it is only so far removed out of its parallelism as to accommodate it to the necessary angle in which the motion requires to be communicated.

The consequence of my arrangement is, that the power of the screw or spiral, as I apply it, whether it be driver or driven, is no longer exerted in the direction of its length or axis, but in that of its radius, consequently it can be driven by the wheel with the same facility that it will drive the wheel, (difference of leverage according to their respective radii only excepted) and thus it becomes changed from its character of the endless screw to that of a pinion of a single leaf, but which leaf being extended quite round the arbor, never becomes disengaged from the tooth or cog with which it is acting, until the arbor has made an entire revolution, and by that time another tooth or cog is ready to engage with it, by which the most steady and equable continuous motion is produced. Independent of the last-mentioned advantage from the circumstance of the wheel and screw having their axes parallel, or nearly parallel to each other, and from there being but one point of bearing in action at once, and that uniformity on the line of centres, and that action passing over equal spaces in equal

times, and in the same direction; all the sliding action which would take place between a wheel and an endless screw, is converted into a complete rolling action, whereby nearly the whole of the friction that would otherwise occur, is destroyed, so that the mere external appearance of an endless screw is maintained without any of its detrimental properties; and as all the points of contact must be in the line of centres joining one axle to another, without the possibility of change, so it follows that this new mode of constructing gears resembles most closely an endless or perpetual series of levers, and that its action is more equable and regular than any gearing heretofore constructed.

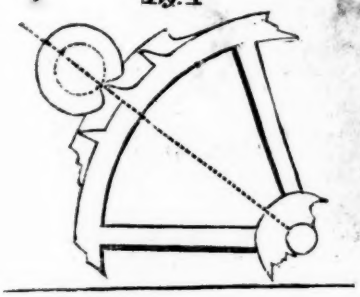
As the tooth of the wheel may be admitted into, and made to bear almost close to the centre of the arbor or at any rate much closer than where a pinion is used, a great difference of relative motion may thereby be given from one wheel to another, or from a wheel to any arbor, as is required in many parts of clock and watch work, and many other machines; and farther by this arrangement, a great comparative increase of power or velocity may be gained. Consequently, this gearing is equally applicable and valuable when a quick or powerful motion is required; and it possesses one perfectly original and valuable feature, that any required strength may be given to the arbor without affecting either its power or velocity. This will be rendered evident by an inspection of fig. 3, in which the external lines *ee*, and *ff*, represents the sec-

Fig.3.



tions of two arbors of very different sizes, and consequently strength, while their mechanical action is exactly similar. The section is taken transversely through that part of the arbor on which the spiral groove in which the tooth is to act, is formed as at *g*, in both the sections, but it will be seen, notwithstanding the difference in magnitude of the two sections, that they have but one common pitch line marked *ii*, in both the figures; and as these pitch line circles are of equal diameter, (by a slight inadvertency, the circles *ii* in the figure are not exactly of the same diameter, as they ought to have been, according to the description,) it follows that the two arbors may work into the same wheel, and that their power and velocity must be equal, notwithstanding their disparity in strength, which gives my arrangement a decided superiority, for even when the tooth of the wheel is brought almost close to the centre of the arbor, which is next to impossible either in common or oblique toothed wheels and pinions, I can upon this principle always command as much strength in the arbor as may be requisite for the work it has to perform; all that is necessary being to cut or file away the external circular part of the arbor, shown by a dotted line at *h*, to such an extent as to clear the next two adjacent teeth, before they come into action, as will be seen in fig. 4, which represents part of a wheel with bevelled teeth acting into a grooved arbor, also shown in section as in fig. 2. The point or lines of this arbor, on which the tooth of the wheel bears, must be calculated as follows; having ascer-

Fig. 4



tained what power or velocity we are in pursuit of, and the means of getting at the same, the arbor must be made of sufficient thickness to insure strength enough to resist what it has to bear, next the distance of the bearing point, or pitch line, from the centre of the arbor, must be determined; and this may be taken at pleasure, except only that the tooth to act into it should not be made so long as to weaken it; but where greater length than ordinary is necessary, the teeth may be round bottomed, or else shaped as in fig. 4. The angle which the teeth of the wheel make with its axis, should be rather obtuse when the wheel is to be driven, and rather acute when it is to be the driver, which variation in angle will not affect the power of the gears, since this must always be in proportion to the diameters of the respective pitch lines acting together, and the number of teeth will not be affected.

To determine the size af the wheel, it must be noticed that the arbor with its spiral grooves above described, will make one complete revolution for each tooth of the wheel with which it is connected, consequently the wheel must have as many teeth as it is intended the arbor shall make revolutions for one turn of the wheel, and the distance between one tooth, and another upon the wheel must be equal to three times the diameter of the pitch line or circle of the arbor, therefore if this last mentioned pitch line has been first determined as aforesaid, it will determine the size of a wheel to work into it with any assigned velocity, because we have only to multiply the diameter of such pitch line by three, and its product by the number of teeth or revolutions required to obtain the length or circumference of the pitch line of the wheel as sought; or, on the contrary, if the size and number of teeth of the large wheel be given, the pitch line of the arbor must be one third of the distance between its two teeth from centre to centre. In the construction of my aforesaid wheels it is evident that the angle which the teeth make with the axis of the wheel may be varied without varying the number of teeth in such wheel, but in this case the breadth of the face or periphery of the wheel must be altered, because, in every case the inclination of the teeth must be so set out that lines drawn parallel to the axis of the wheel and to each other may touch or connect the centre lines of two contiguous teeth at their opposite ends, such line being parallel to the axis of the wheel *a*, fig. 1. and at the same time touching the lower end of the tooth *m*, and the higher and of the tooth *n*, the intention of this being, that so soon as any one tooth has passed the spiral groove in the arbor, and is just about to be withdrawn from it, the next suecceding tooth may

be ready to enter and engage with it.

The spiral groove on the arbor must in every case be of a length corresponding with the breadth of the wheel with which it has to engage, and if the arbor is required to make one revolution for each tooth of the wheel, this groove must, in its length, traverse exactly once round the arbor. On the contrary, if two or more revolutions of the arbor are required to be made for each tooth of the wheel, then the spiral groove must extend twice or more round the arbor; but this is a construction I do not reccommend, since to obtain additional velocity, it is always better to increase the size and number of teeth in the driving wheel; but where a slower motion is required in the arbor, it may be very well brought about by forming two or more spiral grooves, each extending half, or a quantity in proportion to their number round the arbor, and then letting them engage with two or more successive teeth to produce one revolution of the arbor. The curve of the spiral groove upon the arbor may be found by covering the edge of the wheel with a strip of thin paper, and marking the bevel of one tooth upon it, when the extension of that tooth may be cut off and wrapped round the arbor, which will give the form of spiral which may be marked and cut, but this is only a proximate method, and I recommend that the groove should be cut in a regular and proper engine for cutting screws or spiral grooves of this description; but as the process of cutting the spiral groove forms no part of my aforesaid invention, and as it is well known and understood by every competent workman, I shall not describe it, but will merely state that the smoothness and perfect working of my aforesaid improved gearing, depends, like all other wheel work, on the perfect workmanship of the teeth and grooves, and their being well finished and fitted to each other.

I may also notice generally that as this gearing tends to produce a lateral bearing on the several arbors or axles employed in it, the friction of the pivots may be very greatly diminished, particularly in small and light work, by making them revolve in central points instead of using pivots with shoulders working in holes. because in this way much smaller moving surfaces are brought into contact.

So far I have only described the manner in which my machinery or gearing is to be constructed and applied when the axes of motion of the different wheels and arbors are parallel to each other: but it will be evident that my aforesaid improvement applies equally when this is not the case, or to the construction of what are technically called beaver gears. The only difference in the construction in this case is, that instead of making the wheels and arbors true cylinders, which they should always be when used for parallel axes or arbors, that both the wheels and arbors must be conical to the same extent, and in the sams proportion as is used for common bevel gear with cogs, the rules for which are well understood by mechanics. What has been said respecting the formation of my bevel or oblique teeth upon cylindrical wheels equally applies to them when they are formed upon conical wheels. And the spiral groove in the arbor must be cut upon the conical part of it, but motion at right angles may be also communicated by means of a contrate or face wheel, with bevel teeth acting into an arbor lying in the same plane of the wheel, in which case its conical form will be determined by two radii of the wheel into which it is to act, to the intent that the smallest diameter of the part of the arbor where the spiral groove is cut may be in the same proportion to the diameter of the circle formed by the inside of the teeth, as the largest diameter of the pivot is to the diameter of the outside of the teeth.

One of the great advantages of my aforesaid improved combination of gears, is the simplicity which is thereby introduced into machinery, and the consequent diminution of friction, for since each tooth in the wheel will produce or be equivalent to an entire revolution of the arbor, a great say-

ing in wheels may be effected: thus for instance, if a common wheel has 100 teeth, and this works into a pinion of ten leaves, the same power or velocity may be obtained in my improved gearing, by using a wheel with ten teeth working into one spiral groove upon the arbor; as an example of which, fig. 1 is a side, and fig. 2 an elevation of a regulator clock, (vide frontispiece) and which is capable of showing hours, minutes, and seconds, and will go for a whole year with once winding up by a weight of only a few pounds: indeed, such is the variation in power and velocity which my aforesaid gearing admits of, that although the wheels may be large, and made to contain many teeth, yet they may be diminished in size and number of teeth to a single tooth, and if this is made to bevel or traverse once round the cylindrical or other wheel, in the manner of a screw, it will work into the spiral groove of another cylinder or conical arbor, as the case may be, and each of them will perform their revolution in the same time.

The objects which I claim as my particular invention and property are therefore, not the wheel with bevelled or oblique teeth, or the endless screw in their separate and detached state, but the combination of them in the form hereinbefore described, in which the power of the screw is exerted in the direction of its radius instead of that of its axis, whereby I am enabled to apply my power much nearer to the centre of the arbor, than in any other modification of wheel-work, and thereby to obtain greater power or velocity than has hitherto been effected, and with much less friction, on account of the rolling motion that is induced instead of the rubbing one, and having only one point in wheel or arbor in action at once, and that always in the line of centres, which, together with the power that I possess of giving strength to my arbor, constitutes an entirely new system of gear work requiring less space, less materials and consequent weight, less labour for its construction, and less friction when completed, than any other gear work which has been hitherto constructed.

BEST MEANS OF LIGHTING A FIRE.

From the House Keeper's Magazine.

Fill your grate with fresh coals quite up to the upper bar but one; then lay in your faggot of wood in the usual manner, rather collected in a mass than scattered, that a body of concentrated heat may be produced as soon as possible; over the faggot place the cinders of the preceding day, piled up as high as the grate will admit, and placed loosely, in rather large fragments, in order that the draught may be free; a bit or two of fresh coal may be added to the cinders when once they are lighted, but no small coal must be thrown on at first: when all is prepared, light the wood, when the cinders becoming in a short time thoroughly ignited, the gas rising from the coals below, which will now be affected by the heat, will take fire as it passes through them, leaving a very small portion of smoke to go up the chimney. The advantage of this mode of lighting a fire is, that small coal is better suited to the purpose than large, except a few pieces in front, to keep the small from falling out of the grate; it may be kept in reserve, to be put on afterwards if wanted. We have frequently known our fire, lighted at 8 o'clock in the morning, continue burning till 11 at night, without any thing being done to it: when apparently quite out, on being stirred, you have in a few minutes a glowing fire: it will sometimes be necessary to loosen, or to stir slightly the upper part of the fire if it begins to cake; but the lower part must not be touched, otherwise it will burn away too soon entirely.

INSTANTANEOUS LIGHT-BOXES.

From the same.

The *liquid* is concentrated sulphuric acid. The bottle containing it ought never to be opened except when used; for the acid, when exposed to the air, imbibes moisture very rapid-

ly, and is soon spoiled. The *matches* are prepared as follows:—the ends of some small slips of light wood are dipped into a strong solution of gum, and afterwards into the mixture of chlorate of potass and sulphur, prepared by rubbing two grains of the former into a fine powder in a mortar, and adding one grain of flour of sulphur; then mix them very accurately, by well triturating them in the gentlest possible manner. The powder is fastened to the wood by the gum, and the matches when dry are fit for use. Then take one, and dip into the liquid, upon which it takes fire.

TO MAKE INK FOR PRINTING ON LINEN WITH TYPES.

From the same.

Dissolve one part of asphaltum in four parts of oil of turpentine, and add lamp-black, or black lead, in fine powder, in sufficient quantity to render the ink of a proper consistence for printing with types.

TO EXTRACT GREASE-SPOTS FROM LINEN.

From the same.

The following method is not generally known, and is certainly the most simple, and (we speak from experience) the best we ever met with:—Take magnesia in the *lump*, wet it, and rub the grease-spots well with it; in a little time brush it off, when no stain or appearance of grease will be left on the linen.

TO CURE DISEASES IN HORSES' FEET.

From the same.

Every person may see, upon turning up the bottom of a horse's foot, an angular projection pointing towards the toe, termed the *frog* and its *bars;* the remainder, or hollow part, being technically termed the *sole*, though the *entire bottom* of the foot might better receive this name. It is certain, however, that "the frog and sole" require *pressure*—a congenial kind of pressure without concussion—that shall cause the sensible, inside, or quick-sole, to perform its functions of absorbing the *serous* particles secreted, or deposited therein by the blood-vessels. If the frog and its bars are permitted to remain in such a state as to reach the ground, wherever the sod happens to be soft or yielding, the hollow part of the sole receives its due proportion of pressure *latterally*, and the *whole sole*, or surface of the foot, is thereby kept in health, or rather, free from *canker*.

Prevention.—Every veterinarian of sense will perceive the necessity of keeping the heels apart; yet, although the immediate cause of their contracting is so universally known and recognized, the injudicious method (to call it by no harsher name) of paring away the frog and sole, which prevents the bars from ever touching the ground, is still continued to an alarming extent.

Horses' hoofs are of two distinct kinds or shape; the one being oval, hard, dark-coloured, and thick; the other, round, palish, and thin in the wall, or crust of the hoof. The first have a different kind of frog from the latter; this being broad, thick, and soft, whilst the oval hoof has a frog that is long, acute, and hard. The *rags* which hard work and frequent shoeing occasion on the horny hoof of the *round foot*, produce ragged frogs also, both being thus pared away to make a *fair bottom* to receive the shoe (burning hot!) the whole support is so far reduced, and the sensible sole coming much nearer the ground, becomes tender, and liable to those painful concussions which bring on lameness—principally of the *fore feet*.—Contraction of those kinds of heels which belong to the *cart-horse*, and pommice-foot, are the consequence.

The *oval foot* pertains to the saddle-horse, the hunter, and *bit of blood* kind, whose bold projecting frogs the farriers remove, and these being compelled to perform long and painful journeys, ever starting or going off with the same *leading-leg*, and continuing the same throughout, lameness is contracted in that foot, which none can account for, nor even find out whereabout it may be seated.—Applications of "the oyls." (that

egregious compound of folly, ignorance, and brutality,) follow the first appearance of lameness, and are made alike to the shoulder, the leg, and the sole, under the various pretences of rheumatism, strain in the shoulder, and founder. The real cause, however, is not thought of, much less removed; but, on the contrary, the evil is usually augmented, by removing the shoe, and *drawing the sole* to the quick nearly, in search of supositious corns, surbatings, &c.—pretended remedies, that were *never known to cure*, but which might have been all prevented by the simplest precautions imaginable. These are 1st.—Let the frog and sole acquire their natural thickness. 2nd. Lead off sometimes with one leg, sometimes with the other. 3rd. Stuff the hollow of the hoofs (all four of them) with cow-dung, changing it *entirely* once a day. In every case, it is advisable, that he be worked *moderately;* for it is useless to talk to the owners of horses about giving the afflicted animal an entire holiday at grass.

Procure a phialful of water, and putting therein a little salt-petre (*nitrated kali of the shops,*) and a little *colouring* matter, to be either mixed with the *stuffing*, or to wash the sole clean daily. A more efficacious auxiliary will be found in procuring a *patch of clay*, to be kneaded on the ground, on which the animal (which is worth so much trouble) may be allowed to stand, and if a small patch be made for each foot, the horse himself will prove their value (in most cases) by feeling for them, as it were, and showing by his *manner* how gratified he is at the coldness they afford to his heated feet. Herein it must be observed, that *stuffing with clay* is not recommended.

TO SPLIT LARGE STONES.

From the same.

Kindle a fire on the upper surface, which being expanded by the heat, the stone splits. The hardest and largest stones may be split by this method, continuing the fire, and increasing the heat in proportion to the size of the stone.

INCREASE OF THE SOUND OF ARTILLERY.

From the London Mechanic's Magazine.

SIR—From observing how the power of the human voice was increased by the speaking-trumpet, I was led to think, that if the muzzle of a gun was made of that form, it would have the same effect on its report when fired, and immediately resolved to try the experiment. I fixed a mouth-piece, about the size of a bugle, on a common pistol, and accordingly found the report increased in a surprising manner. A piece of artillery, no doubt, would require a mouth piece much larger than this to have a corresponding effect; and it would have to be made so strong, as not to be shaken by the violent concussion. This discovery, I dare say, will be of little moment to the public; unless, indeed, when they wish to show the extent of their satisfaction by the greatness of the noise they make—I mean when they rejoice; and I think it will be the opinion of most people, that the report of a cannon is quite loud enough already.

Yours, &c. JOHN WELSH.

LEAD MINES.

The lead mines of Missouri cover an area of more than 3000 square miles, and are said to be the most extensive on the globe. The ore is of the purest kind, and exists in quantities sufficient to supply the whole United States. The number of mines is 165, in which more than 1100 men are employed, producing annually 3,000,000 pounds of metal, valued at 120,000 dollars.

ARDUOUS WORK WITH THE DIVING BELL.

From the London Mechanic's Magazine.

SIR,—On a beautiful headland, called Cremill Point, which stretches above a mile and a half into Plymouth

Sound, it is resolved to erect the chief Victualling-Office for his Majesty's navy—a more suitable place is no where to be found on the whole coast of Britain; and when finished, according to the plans of that eminent engineer, Mr. Rennie, like the Breakwater and Eddystone Lighthouse in its neighbourhood, it will form one of the most prominet objects of art and utility to be seen in the world.

For some time back the work has been going forward, and in excavating the rock on which to lay down the foundation of the sea-wall, the diving bell has shown itself more than ever an engine by which mankind can really accomplish wonderful tasks, so much so, that, for the benefit and amusement of mechanics, a brief account may be welcome.

The waters of Hamoaze (on whose bosom repose in peace so many of our noble war-ships,) while moving to and fro into the Sound with the ebb and flow of the ocean, have caused one of the sides of the shore of Cremill Point to dip from the land with a great declivity; twenty yards from high-water mark, and less, the sounding is above twenty-five feet; and beyond this a *sea precipice*, if the expression may be used, almost descends perpendicularly to the depth of fifty. On the brink of this precipice the sea-wall is to stand; so that ships of any burden, although they draw twice as much water as they do, may come alongside at *low water*, if they please, and be victualled.

From the land, a wooden stage runs out, the standards of which are shod with iron, to fix on the rock, and they are held down by large stones bolted to them. On this stage the diving bell is wrought in a moveable frame, which gives it a bottom of more than twenty feet square; while beside it, in a boarded house, the air pump stands, which ever keeps in supply the bell-men boring the hard limestone rock beneath. But hardness is not the worst property belonging to it, for it lays the *wrong way*, as quarriers term it; that is to say, its *strata* and *slope* toward the deep (which is nearly a yard vertical for a yard horizontal) run contrary to one another, and cannot be moved by any power but gunpowder, which is put in tin canisters, and inserted in the holes bored; to each of these canisters is attached a small tube of the same metal, about four feet long; when a shot is charged, and put in its place, the signal by the bell-men to those at the top is given, and the bell is hoisted up until the water comes within a few inches of the mouth of the tube, which *mouth* is made wide, like that of a small trumpet, in order that another tube may be fixed in it, which is done watertight with white lead; another length brings it above the surface, when it is fired by letting a small tube of red hot iron run down. No agitation worth speaking of, takes place in the surface-water, but the percussion operates on a boat's bottom near it, and will cause it to leak. The boat that held the fire which supplied the iron matches has been therefore rendered useless, and a raft, of short logs bolted together, now answers the purpose better.

This operation of blasting takes place always at low water, when there are from eight to ten feet of water on the shotless labour, and tubing to correspond; though it is a question as yet unsolved, whether a shot at high or low water, of the same extent of *bore*, will do the most execution. The tin tubing is never all destroyed by one shot—probably *one length* is lost, the rest answers another time. When the shot is fired, the tubing leaps out of the water, and is caught by the bell-man.

I have been thus particular, from the hope that some *better invention* than the one now in use may be discovered, for blowing rocks under water; although, I am sorry to say, that in *blowing rocks upon land*, nothing new has been discovered from the first attempt, which took place some hundred years ago. It is singular, too, that no mechanical art can be applied to the jumper, in order to lessen this most laborious of all labour, and which is much more so nearly thirty feet beneath the water, in a diving-bell, where the pressure acts on

the lungs very much. When any great exertion is made, the *mouth* is obliged to be *opened wide*, in order to give the breast its needful allowance. In summer, when the air is very rare, it is more difficult to work in the bell than in winter; and what is rather strange, custom never does away with that nauseous feeling we have in the ear and on the glands of the neck, on being let down in a diving-bell.—Those quarriers who have wrought in it for years, feel the sensation every time they are let down into the deep, the same as strangers do. It is a sensation much like that felt when learning to blow a trumpet, or in compressing air with the mouth. Some have it much worse than others; and to those who have a stoppage in the ears, or who are troubled with deafness, I should recommend them to try if the diving-bell contained a cure, as I think it does.

Yet this is not all the bell-men quarriers have to surmount at the Cremill Point: from the steep slant of the rock, the sea-side of the diving-bell is commonly two or three feet from the bottom; so the poor fellows bore away, quite happy, and generally very healthy, up to their middle, and more, in water. The excavation is shoved from under the bell, over the brow of the beforementioned precipice.

But the chief part of this business of excavating lies in giving the slope of the rock the other way; for the foundation of the wall is not to be level, but to be three feet deeper at the back than at the front; this is because the wall is not to be perpendicular, but curvilineal, with a radius of seventy-one feet. This is the kind of wall nature requires in such situations, for the curve or arch of this radius is what may be termed the *sea-surge curve*, and is to be seen on all shores having beaches of pebbles.—This *curve* was first discovered by Mr. Smeaton, and happily applied by him in the erection of his monument, the Eddystone Light-house, and since applied by engineers to sea-walls, and walls of counter pressure, being found to answer the end better than any other.

I must not trespass more on your room at this time, although I would wish to explain many matters more in full respecting the diving-bell, which have not yet, I believe, been treated of by any person.

A MECHANIC ON THE WORK.

PENNSYLVANIA CANAL.

It appears from the Transactions of the House of Representatives of Pennsylvania, now in session, that they are about making the necessary inquiries through the Committee of Inland Navigation, &c. with regard to the expediency of commencing forthwith the construction of a canal to unite the waters of the Ohio River and Lake Erie with the Susquehanna—thus following the noble example of New-York in facilitating the means of transporting the immense quantities of produce that are coutinually and increasingly accumulating in our western states and along our lake shores. More land is annually put under cultivation, considerable more produce is raised than is wanted for home consumption, and the nearest market for the surplus will be found on the shores of the Atlantic. We therefore hope that no time will be lost in the commencement of this work.—Pennsylvania has stood a quiet spectator long enough.

Though her capital partakes largely in an inland trade, still no attempt has heretofore succeeded in uniting the waters of her rivers with those of the western country.

May we not hand her the shovel and the spade? may we not say go on and prosper—patience and perseverance will remove mountains?

Annexed we publish the resolutions adopted by the Representatives at Harrisburg, on Saturday, Dec. 11.

"Whereas experience, not only in foreign countries, but in many parts of the United States, demonstrates the utility of canal navigation, in promoting the prosperity, strength and happiness of the community: and there is reason to believe that the Union Canal which is rapidly advancing towards completion may be extended to the Ohio and Lake Erie, and that the eastern and western waters may be united in Pennsylvania, and not only local interests be promoted, but the commerce and the union of the states be essentially benefited, and the reputation of our free institutions exalted—

"And whereas a canal through Pennsylvania, from her climate, her arable land, her coal, iron and other mineral treasures, and the greatness of her commercial emporium, promises to be not only more advantageous to the people of Pennsylvania and of the western states, but also more productive in the shape of tolls, than any other which can be constructed for the purpose of uniting the Atlantic with the western waters—Therefore,

Resolved, That the committee on inland navigation and internal improvement be instructed to consider the expediency of commencing forthwith, at the expense of the state, the construction of a navigable canal, from the termination of the Union Canal on the Susquehanna to the mouth of Juniata, and from Pittsburg on the Ohio to the mouth of Kiskiminatas, and as soon thereafter as practicable to extend such canals, either by means of the waters of the West Branch, or Juniata, so as to connect the Susquehanna with the Ohio, and also by the most eligible route to connect the Allegheny with Lake Erie.

Resolved, That the committee on inland navigation and internal improvement be instructed to consider the expediency of establishing a board of public works for the purpose of protecting the interest of the commonwealth in existing roads, bridges, and canals, superintending the execution of such canals as may be undertaken by the state, and devising new schemes of internal improvement."

WATCH KEYS.

Agricola, in No. 38, apparently in answer to Sinex, in No. 15, endeavours the give the reason for their change in fashion—he says, the old shape was so crooked as to be inconveniently liable to catch ladies' gowns in dancing, &c. Very good reasoning, truly; but I think the same reason might be more justly assigned for their remaining in fashion so long as they did. This reminds me of an anecdote of these same keys. At a ball in celebration of the coronation of George IV. Miss A——t dropped her handkerchief; the Duke of P——a, who was sitting beside her, politely stooped for it, but having one of the old fashioned crank keys attached to his watch, it caught the fringe of the lady's gown, and, notwithstanding he raised himself briskly, his watch was not precipitated from his fob, nor his chain broken; and, unfortunately, all the eyes of a room full of company were upon the Duke and the young lady at the time the accident happened. But to the keys.—The old fashioned crank keys were the most awkward articles for watch winding that I ever saw; I should as soon think of boring oak timber with an auger that had a lever upon one side only, as I should to wind a watch with one of these keys, especially if they were not very closely fitted to the arbor of the watch; and then they would be inconvenient to put on and off: besides, they would soon burnish out the pivot holes of the main wheel, by bearing the lower side of the arbor hard against the upper hole, and

the opposite side on the lower hole, whereby an improper depthing between the main and centre wheels would be the consequence, and the watch would in a short time stop of course.

The best and most secure key that I have ever seen is a small round key, quite eliptical from the top to the pipe, and furnished with a click to work opposite the fuzee click; by taking it between the thumb and fore finger, it can be rolled two or more revolutions, and then is immediately rolled back without losing your hold, the pipe turning in the key with a click; and thus, by turning it forward and backward a few times, you have your watch wound up without any strain or injury whatever from winding.

HIRAM.

New-York, Dec. 1825.

VARIETY.

From Various Papers.

Although the lower orders of the Irish are famous for a species of ready wit, mingling volatility and a rich vein of humor, they are no less marked by a quaintness of expression and a mental reservation calculated to gain time and evade inquiry, or having that brought home to them which they wish to avoid: of this last complexion is Shelah's answers to a magistrate.—"What's gone of your husband, Shelah?"—"What's gone of him, your honour's worship; faith, and he's gone dead."—"Ay, pray what did he die of?"—"Die of, your honour; he died of a Tuesday."—"I don't mean what day of the week, but what complaint."—"Oh, complaint, your honour; faith and its himself did not get time to complain."—Oh, oh! ay, he died suddenly"—"Rather that way, your worship."—"Did he fall down in a fit?" (No answer from Shelah.) He fell down in a fit, perhaps?"—"A fit, your honour's worship; why, no, not exactly that, he, he fell out of the window, or a door, I don't know what they call it."—"Ay, ay; and he broke his neck."—"No; not quite that, your worship."—"What then?"—"There was a bit of string, or cord, or teat like, and it throttled poor Mick."—"And pray for what did he suffer?"—"Suffer, your worship (weeping) faith, only for embellishing (embezzling) a trifle that he *taught* was his own, but his master said it was *not*, and so they swore away his precious life, and that's all; Mick's as innocent as a babe unborn."

The following advertisement appears in a daily paper, dated from a green-shop.—Who shall say that the age is not refined?—

"The writer, who has just passed 40, and has but a few years more to live, in the blaze of passion of feeling, would fain taste all that he conceives possible of pure and ardent friendship. He can attach himself only to mind, refined by education and the best society—birth and fortune are disregarded by him, though possessed of the advantages of both; he would not cultivate the friendship of one, who, being without them, should be allured to him by the attractions of either."

Extract of a sermon preached by Sam Quaco, a black clergyman, and native of Jamaica:—"A man dat's bon ob woman, hab no long time to lib; he trouble ebery day too much; he grow up like a plaintain; he cut down like a banana. Pose de man do good, he get good; pose de man do bad, he get bad; pose he do good, he go dat place call him glorio, where Gor-a-mity tan upon de top, and debble on de bottom; pose he do bad, he go to dat place call him hell, where he must burn like de pepper-cod; he call fo drink ob a wara; nobody give him drop to cool he dam tongue."

If you see a male and female constantly thwarting each other, under the appellation of my dear, my life, &c. rest assured they are husband and wife.

QUERIES.

If you take a tea kettle with boiling water in it off the fire, and immediately put your finger to the bottom, outside, you will find it almost cold, or at least a considerable degree below the temperature of the water; but in a few seconds the heat will increase. What is the cause of this? The water in the vessel is at 212 deg. Fahrenheit's Thermometer, consequently the fire is much higher, and yet the substance between them perhaps only 60 or 70 deg.

Is it possible that combustion can take place without the presence of oxygen, or in a vacuum?

INQUIRIES.

Sir,—As your truly valuable Magazine extends itself to (I hope) every manufactory, it has, no doubt, before this found its way to some of our tin-plate workers, and if so, I should be glad to be informed, through the medium of your columns, what method is practised to anneal iron plates, and to get off the scales from the face of them, prior to their being tinned, as I apprehend it is absolutely necessary that the plate should present to the tin a perfectly clean surface, free from scale or oxide of any sort.

Your humble servant, * * * * *.

What is the best and easiest method of extracting the pulp from potatoes, in small quantities (say one peck,) at a time; as well as the best method of extracting the dirt, &c. from them when ground. Diagrams of potatoe mills or grinders, have been given in the "Register of Arts and Sciences," and "Scientific Gazette;" but machines upon such principles would be much too large and expensive for my purpose; my object is to unite economy with portability.

By some of your scientific friends noticing the above query at an early opportunity, they will confer a favour on GUILLETT.

METEOROLOGICAL TABLE.

	Thermometer 8 in the morn	Thermometer noon	Thermometer 10 at night	Remarks
Dec. 31—Saturday	41°	44°	40°	cloudy rain
Jan. 1—Sunday	40	42	33	rain
2—Monday	30	34	31	clear
3—Tuesday	30	41	37	cloudy
4—Wedns'y	39	39	24	clear
5—Thursday	21	32	25	clear
6—Friday	22	33	32	clear

Communications for the 'American Mechanics' Magazine' post paid, and addressed to

C. S. WILLIAMS,

No. 252 Broadway, will receive due attention.